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European Trade Patterns After the Transition

Oleh Havrylyshyn
and
Lant Pritchett

A gravity model of trade predicts that trade with Northern Europe will increase from less than 25 percent to more than 70 percent of Eastern Europe's trade.

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This paper — a product of the Trade Policy Division, Country Economics Department — is part of a larger effort in PRE to examine questions relating to the transition from a socialist to a market economy. Copies are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Nen Castillo, room N10-033, extension 37947 (29 pages, with tables).

Eastern Europe's shift away from socialism and an orientation toward the USSR is likely to cause large changes in its bilateral pattern of trade — away from the Eastern bloc toward the Western.

Havrylyshyn and Pritchett quantify the expected magnitude of this shift by estimating a traditional gravity model of trade and using it to simulate post-transition patterns of trade.

In the base case — in which the total value of Eastern European trade is held constant at US$113 billion — Eastern European trade with Northern Europe increases by $53 billion.

Northern Europe's share in Eastern Europe's trade increases to more than 70 percent, from the current level of less than one quarter.

The basic tenor of these results is robust to changes in the model's estimated coefficients and the measurement of income in Eastern Europe and the USSR.

European Trade Patterns After the Transition

by
Oleh Havrylyshyn
and
Lant Pritchett

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Direction of Trade after Transition in East Europe: Predictions from a Gravity Model

I) Introduction

Until recently the geographic pattern of exports and imports in East and Central Europe (ECE) was determined less by market forces and more by the political and economic relationship binding the ECE states and the Soviet Union in the CMEA. This gave a recognized bias to bilateral trade patterns, resulting in excessive geographic concentration within the CMEA. With the disappearance of the CMEA and the transition to market economies, an interesting question arises: how and how much will these biased trade patterns change? Several recent analyses of East European trade (CEPR, 1990; Collins and Rodrik, 1991; Havrylyshyn and Tarr, 1991) have provided qualitative substantiation of the widely expected changes: a geographic shift from "east" to "west" and a reduction in the share of heavy industry in the export basket. These early studies have relied on qualitative arguments and relatively rough quantitative methods such as comparing ECE with Southern Europe, or to their own 1920s trade patterns.

This paper will concentrate on geographic direction of trade only, and apply a fairly conventional gravity model technique to answer the question: what would be the geographic pattern of trade of ECE if their trade were determined by the same factors as those that affect market economies?

We estimate a gravity model of bilateral trade using import and export data from a group of economically similar but non-socialist countries. The estimated coefficients of this model are used to simulate the pattern of trade for six ECE countries. We find the bilateral pattern of trade in Eastern Europe is markedly different from that expected for countries of their income level, location and size. Actual trade of ECE with Northern European countries is one-half its predicted value, a difference of US$ 53 billion. Actual trade of the ECE countries with other ECE countries and the USSR is more than triple the predicted amount. Section II presents the model and the estimation results for a sample of non-socialist countries. Section III reports the ECE simulations. Section IV discusses implications and concludes.

II) An empirical gravity model of bilateral imports and exports

The volume of bilateral trade flows is well explained empirically by the proximity and the total incomes of the partner countries, as shown exhaustively by Linneman (1966). The gravity model[1] has been used extensively to examine various effects on bilateral trade of inter alia; preferential trading areas [Aitken (1973), Thoumi (1989)], political relations (Summary, 1989), colonial ties (Srivasta and Green, 1986). Although theoretical rationalizations for the gravity model can be generated (Bergstrand 1985, 1988), in the present context the strong

[1] The gravity model is so named because of the analogy of trade flows to gravitationally force between objects that depend on their mass and the distance between them.

empirical performance of the model is sufficient rationale for its use.[2]

Model Specification and Data

As in standard gravity model here the value of trade between two countries is postulated in equation 1 to depend on the total trade potential of each country and the trade attraction between them.

1) $T^{ij} = f(TP^i, TP^j, TA_{ij})$

A country's trade potential depends on its total output and the trade intensity of output. Trade intensity is affected by economic factors, such as the level of development, and geographic features of a country such as the size of the country, or whether it is an island. The share of trade of a particular partner depends on the partner's trade potential and the trade attraction. The trade attraction is a function of geographic proximity, economic similarity, the existence of preferential trading arrangements and cultural similarities.

Bilateral non-fuel import and export values in US$ are the dependent variables. Data was assembled for variables representing the trade flow determinants. Total output is current US$ GDP. GDP per capita in US$ at PPP rates was included

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[2] In his 1984 review article on empirical trade models Deardoff says "In spite of their dubious theoretical heritage, gravity models have been extremely successful empirically."

to capture the effects of the level of economic development.[3] Size is measured by land area in square kilometers, and a dummy variable is included for islands.[4] Geographic proximity is captured by the straightline distance between the economic centers of gravity and a dummy variable for the existence of a common border. The absolute value of the percentage difference in per capita GDP (at PPP) is used to proxy economic similarity. A dummy variable was included if both countries were members of a regional trade preference arrangements. Separate dummy variables were included when necessary for the EEC, EFTA, LAFTA, ASEAN, and CACM. Our proxy for cultural similarity is a dummy variable which equals one if countries share a language. Separate variables are included for English, Spanish, Portuguese and Arabic. The model estimated equation was equation 2. The precise definitions and sources for all data are in the data appendix.[5]

$$\begin{aligned} \text{non-oil trade}^{ij} = {} & \beta_1(\text{distance}^{ij}) + \beta_2(\text{border}^{ij}) + \gamma_{11}\text{GDP}^i \\ & + \gamma_{12}(\text{GDPPC}^i) + \gamma_{13}(\text{Area}^i) + \gamma_{14}(\text{Island}^i) + \gamma_{21}\text{GDP}^j \\ & + \gamma_{22}(\text{GDPPC}^j) + \gamma_{23}(\text{Area}^j) + \gamma_{24}(\text{Island}^j) \\ & + \beta_3(|\text{GDPPC}^i - \text{GDPPC}^j|) + \sum_{k=1}^{5}\alpha^k\text{Region}^k + \sum_{l=1}^{4}\delta^l\text{language}^l \end{aligned} \qquad (2)$$

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[3] GDP measured at World Bank Atlas exchange rates is used for the level of GDP relevant to the volume of trade, while PPP exchange rates (Summers and Heston, 1988) are used for GDP per capita.

[4] Hong Kong and Singapore are considered islands.

[5] The data set is available from the authors on request.

Estimation

The model was estimated in natural logarithms since the range of some of the variables is so large that results in levels are easily driven by extreme observations. The double logarithmic form also gives elasticity results that are easier to interpret and compare with previous results. The data are all averaged from 1980-82, a period chosen to represent a reasonably normal period for trade flows because it pre-dates the debt crisis and the massive dollar appreciation of the mid-1980s.

The appeal of this empirical exercise depends on the intuitive appeal of the counterfactual: if the bilateral trade of socialist ECE countries' were determined in the same way as that of a set of non-socialist countries then it would differ from its current pattern in a predictable way. Critical to the attractiveness of the analogy is choosing countries whose trade is expected to respond similarly to the free market ECE.[6] The model was estimated for two different samples of countries: a) fourteen large, semi-industrialized countries with substantial non-primary exports[7], b) twenty-one non-oil exporting countries with per capita income in 1985 between $2,000 and $5,000 US$ using PPP conversion. CEPR (1990), among others, underlines the broad similarity of ECE with Southern Europe, and the middle income NICs. The imports and exports of each of the sample

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[6] Note we are not asserting the pattern of trade will be the same, only that the response of trade pattern to its determinants will be the same.

[7] The countries are: Greece, Ireland, Spain, Portugal, Turkey, Korea, Taiwan, Singapore, Malaysia, Thailand, Brazil, Uruguay and Mexico.

countries with each of 95 non-socialist partners[8] are used in estimation.

As bilateral trade flows have a lower bound of zero OLS estimates are inconsistent because of censoring bias.[9] Therefore, Tobit maximum likelihood estimation of the equations are reported.

Results

Table 1 presents the estimates of the gravity model, estimated on imports and exports separately, for the two samples of reporter countries. The empirical performance of the standard gravity model is quite good. Nearly all the variables have the expected sign and are strongly significant.[10] Trade decreases with distance and increases with a common border, trade increases nearly one for one with the level of GDP of the reporter and partner, and decreases with size. Not surprisingly common membership in the EEC, CACM or LAFTA has significantly positive affects and, except for Arabic, sharing a common language raises bilateral trade substantially.

There are nevertheless some puzzling results. The impact of the island variables depends on the direction of the flow. The

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[8] The partners are limited to those with total imports in 1980 of more than 300 million.

[9] Greene (1981) gives a formula for the bias of the slope coefficient estimates, which depends on the fraction of the sample at the truncation point. This OLS bias is sometimes ignored when the estimation uses only OECD trade flows, as there are few zero values. However, with middle and low income countries the fraction of observations at zero is much higher, around 20-30% implying a bias of OLS estimates of 25-40%.

[10] Heteroskedasticity consistent standard errors for the MLE estimates (White, 1981) are used.

Table 1: Gravity Model Estimates

	Exports		Imports	
Variables	Sample: Middle income	Large semi-industrialized	Middle income	Large semi-industrialized
constant	-9.54 (1.67)**	3.381 (1.52)*	-3.85 (1.81)*	4.51 (1.70)*
Proximity				
ln (distance^{ij})	-1.56 (0.95)**	-1.62 (.094)**	-1.49 (.099)**	-1.45 (.108)**
border (=1)^{ij}	1.15 (.285)**	.89 (.315)**	1.05 (.293)**	.33 (.40)
Reporter (i)				
ln (GDP^{i})	.864 (.063)**	1.15 (.068)**	.903 (.069)**	.88 (.081)**
ln (GDP/pop^{i})	1.05 (.192)**	-.38 (.17)*	.590 (.204)**	-.39 (.177)**
ln (area^{i})	-.009 (.046)	-.265 (.04)**	-.390 (.053)**	-.33 (.057)**
Island (=1)^{i}	2.71 (.145)**	1.36 (.14)**	.856 (.182)**	.214 (.177)
Partner				
ln (GDP^{j})	.93 (.040)**	.86 (.042)**	1.25 (.045)**	1.16 (.054)**
ln (GDP/pop^{j})	.224 (.067)**	.20 (.069)**	.097 (.079)	.03 (.091)
ln (area^{j})	-.176 (.027)**	-.11 (.031)**	-.21 (.028)**	-.13 (.034)**
Island (=1)^{j}	-.312 (.111)**	-.39 (.120)**	.53 (.108)**	.508 (.139)**
Linder				
$\left\lvert \frac{GDP_i}{pop} - \frac{GDP_j}{pop} \right\rvert$	.075 (.085)	.049 (.079)	.145 (.092)	.18 (.099)*
Preference (=1^{ij})				
EEC	.627 (.211)**	.41 (.206)*	.27 (.279)	.76 (.256)**
LAFTA	.809 (.225)**	.685 (.29)*	1.28 (.247)**	1.04 (.416)**
ASEAN	-1.16 (.618)*	.67 (.462)	.589 (.769)	.92 (.468)*
CACM	3.343 (.381)**		3.52 (.371)**	
ECPF				
Language				
English	1.764 (.300)**	1.30 (.259)**	1.18 (.358)**	1.02 (.322)**
Spanish	.496 (.169)**	.47 (.211)*	.93 (.184)**	.87 (.324)**
Portuguese	3.19 (.95)**	2.53 (.896)**	1.99 (.719)**	1.63 (.654)**
Arabic	1.502 (.353)**	-.004 (.242)	.345 (.356)	-.57 (.435)
Summary Statistics				
N (obvs)	21 (1,995)	14 (1,330)	21 (1,995)	14 (1,330)
s.e.	1.673	1.567	1.761	1.837

Standard across in parenthesis, **(*) significant at 1(5)% level.

effect of GDP per capita of the reporter differs strongly in the two samples of reporter countries. Previous research has shown the presence of a quadratic relationship between GDP per capita and the share of trade in GDP (Chenery and Syrquin, 1975 and McCarthy, et. al. 1984). The large semi-industrialized countries appear to be on the downward sloping portion of the GDP per capita-trade intensity relationship. The variable, difference in per capita income, is mostly insignificant. This is consistent with the literature which finds that Linder effects are limited to the richest industrial countries whose trade is primarily intra-industry (Thursby and Thursby, 1987).[11]

The simple gravity model provides respectable goodness of fit performance, especially for estimation with cross country data. As the goodness of fit for individual countries is important to the credibility of the ECE country simulations, table 2 presents the R^2 for imports and exports for each country calculated using the pooled coefficients. The R^2 for imports (exports) is only twice (once) below .5 and is above .6 for 8 (9) of the fourteen countries. The gravity

Table 2: Country R-squared of gravity model, sample of large semi-industrial countries.

Brazil	0.610	0.768
Spain	0.515	0.738
Greece	0.426	0.698
Ireland	0.631	0.705
Korea	0.551	0.467
Mexico	0.633	0.753
Malaysia	0.634	0.736
Portugal	0.487	0.786
Singapore	0.595	0.597
Taiwan	0.555	0.575
Thailand	0.612	0.506
Tunisia	0.617	0.542
Turkey	0.669	0.742
Uruguay	0.644	0.673

[11] Our data also show a strong Linder effect for the countries with GDP per capita over 5,000 (see below).

model consistently predicts well for nearly all the sample countries, which gives credence to its use for simulating the pattern of trade for individual ECE countries.

III) Simulating ECE Bilateral Trade Pattern

The dissolution of COMECON, the Warsaw pact, and to varying degrees, socialism itself in ECE will likely have important effects on the pattern of ECE trade. A guess of the magnitude of this reorientation of trade can be produced by putting the values of the independent variables for the ECE countries into the estimated gravity model to derive the pattern of trade that is expected if the ECE countries geographical pattern of trade were equal to that of the economically similar non-ECE countries[12].

Tables 3 and 4 present the summary results of the simulation for the imports and exports of the six ECE (Bulgaria, CSFR, Hungary, Poland, Romania and Yugoslavia) countries with each of several regions. The regions include E. Europe (which as a partner region includes the USSR and E. Germany), Northern Europe (all the most developed European countries), and Southern Europe (Greece, Spain and Portugal). The countries included in the other regional groupings are listed in the data appendix. Table 3 reports the results for the estimation period 1980-82 and table 4 for 1986-87, the latest period for which the trade data are available. The predicted total amount of trade (in US$) is

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[12] Bergeijk and Oldersma (1990) use a gravity model, but focus on the implications for changes in total trade, rather than changes in the direction.

Table 3: Value of trade predicted from gravity model, totals for six EE countries by region, 1980-82.

	Actual		Predicted		
	Value (US$ mn)	Share	Value (US$ mn)	Share	Difference as % total trade
Imports, 1980-82.					
E. Europe	25889.06	46.225	6486.284	11.581	-34.644
N. Europe	18340.77	32.748	42317.98	75.559	42.811
S. Europe	991.225	1.770	1634.045	2.918	1.148
N. America	3174.476	5.668	3013.628	5.381	-0.287
N. Afr MEst	3408.527	6.086	732.752	1.308	-4.778
E. Asia Pac	1445.399	2.581	1209.923	2.160	-0.420
S. Asia	506.181	0.904	125.469	0.224	-0.680
S.&C. America	1644.814	2.937	375.159	0.670	-2.267
S.Sah. Africa	606.050	1.082	111.277	0.199	-0.883
Total	56006.51	100.000	56006.51	100.000	

	Actual		Predicted		
	Value (US$ mn)	Share	Value (US$ mn)	Share	Difference as % total trade
Exports, 1980-82.					
E. Europe	33291.96	58.048	11006.23	19.190	-38.857
N. Europe	12723.04	22.184	41885.60	73.031	50.846
S. Europe	1401.626	2.444	1894.961	3.304	0.860
N. America	1542.031	2.689	1129.127	1.969	-0.720
N. Afr MEst	6157.243	10.736	810.590	1.413	-9.322
E. Asia Pac	548.033	0.956	230.106	0.401	-0.554
S. Asia	636.915	1.111	54.286	0.095	-1.016
S.&C. Amer.	428.117	0.746	247.814	0.432	-0.314
S.Sah. Africa	623.973	1.088	94.228	0.164	-0.924
Total	57352.95	100.000	57352.95	100.000	

normalized for each country so as to be equal to its actual level[13]. Even though the predicted overall level of trade is constant, the predicted changes in the direction of trade flows and regional shares are enormous. Actual trade in 1980-82 of the six ECE countries with Northern Europe is US$ 31 bn, or $US 56 billion lower than the simulated value of US$ 84 billion. As

[13] One can also use the gravity model to simulate whether the total amount of trade was higher or lower than expected in the E. countries. However the results for predicting total imports and exports were very sensitive to the estimated constant in the gravity model, which was itself quite volatile to sample selection.

total trade is only US$ 113 billion, half of ECE total trade would need to change direction towards Northern Europe to be consistent with the predictions. The share of Northern Europe in ECE exports is predicted to rise from 24% to 77% and of imports from 37% to 79%.

Conversely the amount of intra-ECE trade (including the USSR) is much higher than predicted by the gravity model.

Table 4: Values of trade predicted from gravity model, totals for six EE countries, average 1986-87.

	Actual		Predicted		Difference as % total trade
	Value (US$ mn)	Share	Value (US$ mn)	Share	
Imports					
E. Europe	27504.96	51.302	6023.051	11.234	-40.068
N. Europe	20215.42	37.706	42644.87	79.541	41.835
S. Europe	750.173	1.399	1777.448	3.315	1.916
N. America	1290.149	2.406	310.123	0.578	-1.828
N. Afr. MEst	663.079	1.237	2077.817	3.876	2.639
E. Asia. Pac	1220.615	2.277	638.294	1.191	-1.086
S. Asia	531.322	0.991	0.000	0.000	-0.991
S.&C. America	1250.432	2.332	138.317	0.258	-2.074
S.-Sah. Afric	187.411	0.350	3.639	0.007	-0.343
Total	53613.56	100.000	53613.56	100.000	

	Actual		Predicted		Difference as % total trade
	Value (US$ mn)	Share	Value (US$ mn)	Share	
Exports					
E. Europe	39991.54	62.880	11190.77	17.596	-45.284
N. Europe	15262.46	23.998	49017.54	77.072	53.074
S. Europe	1174.018	1.846	2076.037	3.264	1.418
N. America	2017.944	3.173	277.392	0.436	-2.737
N. Afr. MEst	3140.434	4.938	1001.698	1.575	-3.363
E. Asia Pac	643.699	1.012	33.421	0.053	-0.960
S. Asia	523.490	0.823	0.000	0.000	-0.823
S.&C. America	508.827	0.800	2.991	0.005	-0.795
S.-Sah. Afric	337.432	0.531	0.000	0.000	-0.531
Total	63599.85	100.000	63599.85	100.000	

Exports are predicted to fall from US$ 40 bn to US$ 11 bn, or from 62% of exports to 17%. Similarly, imports are predicted to fall from 27 to 6 billion, 51% of imports to only 11%. This result amply substantiates the common view that the CMEA and socialist ties were tremendously effective in diverting trade ECE away from "natural" patterns.

The basic result that trade should be higher with Northern Europe and lower with ECE is consistent across all six ECE countries. Appendix 1 presents the detailed country results for 1980-82. Table 5 presents actual and predicted trade shares of each country the with Northern Europe and E. Europe. Not surprisingly Yugoslavia, which was not a member of the CMEA, had the smallest predicted trade reorientation with ECE trade predicted to decline by 13% of total trade and increase by 18% with Northern Europe. Bulgaria's trade with ECE is predicted to be roughly 40% lower with ECE and significantly higher with both Northern and Southern Europe (i.e. Greece, Turkey, Italy). CSFR is predicted to have the largest re-orientation, with the change in trade to Northern Europe over 70% of the current total value.

One interesting result is that trade is not predicted to be very different with North America. In the 1980-82 simulations imports are predicted to fall from US$ 3,174 mn to US$ 3,013 mn. While the decline is perhaps an artifact of the model, (as trade falls off quite sharply with distance), this suggests that the US is not likely to see the tremendously increased trade of the much closer Northern Europe countries.

Table 5: Export and import shares of six EE countries: Actual 1980-84, 1928, and Predicted.

		N Europe			E Europe		
		Actual	1928	Predicted	Actual	1928	Predicted
Bulgaria	Imports	23.2	73.3	43.1	62.9	20.9	28.6
	Exports	10.6	80.3	25.5	73.5	11.8	50.5
CSFR	Imports	23.9	69.0	80.1	65.4	18.4	6.0
	Exports	15.7	66.3	90.0	73.2	22.7	8.0
Hungary	Imports	39.3	53.1	84.5	45.5	39.9	8.4
	Exports	24.8	63.1	86.8	59.1	34.0	10.3
Poland	Imports	30.1	68.9	77.0	52.3	10.6	12.0
	Exports	26.3	78.5	69.4	57.9	19.1	23.4
Romania	Imports	21.5	65.4	74.4	32.5	25.8	10.7
	Exports	27.9	69.2	66.2	36.4	23.2	23.5
Yugoslavia	Imports	54.7	58.6	73.2	24.4	30.6	10.9
	Exports	25.5	76.1	74.8	49.6	21.3	16.3

Sources: 1928 Shares, The network of world trade, League of Nations, 1942. Actuals are from UNSO COMTRADE data.

Confirmations

Since the predicted results are striking, it is useful to compare the results of other methods to verify that they are not wildly unreasonable. Two much simpler calculations suggest that the present results, dramatic as they are, are not at variance with common sense. Table 6 presents the share of European industrial countries in total non-oil imports[14] and exports of several European countries. Actual shares of trade of 70% and 80% are not unusual and these are well within the range of the predicted trade shares for the ECE countries, except perhaps for CSFR and Hungary. Given that these ECE countries are landlocked

[14] The share of "Industrial countries" less North America and Asia in total imports less the imports from the oil-exporting countries.

and completely surrounded by Europe trade shares even higher than those for Greece and Spain are not implausible.

A second simple calculation (used by Collins and Rodrik, 1991, and CEPR, 1990) is to compare historical trade shares. Table 5 presents the shares of trade of certain ECE countries with ECE and Northern Europe in 1928, the last pre-depression and pre-WWII period. In all but a few cases the share of Northern Europe is higher than 60% and well over 70% in a few. Trade data for 1928 will underestimate the ECE share of trade as the economy of the USSR was barely recovering from chaos and was quite autarkic. However trade with other ECE countries may be overstated by historical data, given their relatively slow growth rates over the last 50 years compared to their Western European neighbors. It is noteworthy how close our predicted shares are to the 1928 values in most cases and how far both are from the actuals.

Table 6: Trade shares of some European countries with Northern Europe.

	Imports	Exports
Greece	73.1%	71.7%
Ireland	70.0%	79.5%
Portugal	75.4%	82.5%
Spain	65.8%	68.3%
Turkey	57.1%	65.5%
Belgium	80.4%	80.4%
Denmark	76.7%	73.5%

Source: Direction of Trade Statistics Yearbook, IMF.

Caveats

As in any empirical analysis several limitations and caveats need to be discussed before turning to the implications and conclusions. This section will discuss the weaknesses of each of the three steps in producing the trade predictions: model choice, the model estimation, and the simulation exercise. The first caveat is of

course that the gravity model ignores factors that are potentially important in the determination of trade flows. First, the model makes no distinction between the determinants of inter- and intra-industry trade. Second, the model takes no account of differences in factor or resource endowments that may determine the quantity, as well as pattern, of bilateral trade. Further research intends to explore these limitations but for now are left unresolved. Two potential weaknesses of the estimation of the model are 1) the choice of countries for comparison, 2) the definition and construction of the variables. Since the gravity model per se is of little interest we are only concerned with the model insofar as it affects the outcome of the simulation exercise and the likely direction of biases.

Two groups of comparator countries were chosen. The first involved a "best judgement" on countries which provide a relevant comparison for post-socialist ECE. A less arbitrary criterion involved choosing countries with similar per capita incomes. Both samples produced very similar parameter estimates (table 1). Estimates of the gravity model for the rich industrial countries are significantly different from those for middle and low income countries. This

Table 7: Prediction 1980-82 EE trade shares using gravity model coefficient estimates from different samples.

	Rich Industrial	Large Semi-Industrial
EEurope	14.5%	15.4%
NEurope	67.4%	74.3%
SEurope	3.7%	3.1%
NAmerica	5.2%	3.7%
NAfrMest	2.3%	1.4%
EAsiaPac	3.9%	1.3%
SAsia	1.0%	0.2%
SCAmerica	1.3%	0.5%
SSAfric	0.6%	0.2%
	100.0%	100.0%

may be because trade amongst the OECD countries is dominated by intra-industry trade which has different determinants (see Balassa and Bauwens, 1989). Empirically this reduces the role of proximity and strengthens the Linder effect. But, as Table 7 demonstrates the simulations using the rich country coefficient estimates barely alter the overall conclusions. This further confirms the robustness of the basic simulation results. The predicted share for ECE is the same, around 15%. The diminished importance of proximity in the rich country estimates produces a fall in the predicted share of Northern Europe, with gains for North America (USA) and East Asia (Japan).

The major limitation of the empirical model is that distance is used to proxy for transport costs. Estimates by Geraci and Prewo (1977) and more recent gravity models work by Balassa and Noland (1988) and Barbone (1990) have shown that a country's transport costs depend on the composition of trade, as the freight component of the costs is higher for bulky, low value to weight ratio raw materials than for finished products. Also the relationship between cost and distance may not be the same for ocean versus land transport. However, to the extent the coefficient on distance is higher than most reported in the literature biases the predicted trade flows towards ECE. The primary effect of lowering the effect of distance would be to lower the share of Northern Europe and ECE and increase the predicted share of the US and the Far East.

The simulation method used was chosen to reduce reliance on data on the ECE countries to a minimum. The ECE data do not

Table 8: Estimates of GDP per capita in EE and USSR.

	World Bank (1988)	Keating Hoffman (1988)	UNECE (1988)	CIA (1988)	PlanEcon (1988)	Heston-Summers (1985)
Bulgaria			4244	7510	5630	5113
CSFR		2610	7591	10140	7600	7424
East Germany		2610	12608	12480	9360	8740
Hungary	2460	2830	2621	8660	6490	5765
Poland	1860	640	1818	7270	5450	4913
Romania		470	3072	5490	4120	4273
Yugoslavia	2520			6530	4900	5063
USSR	1735			8850	5550	6266

Source: Derived from Collins and Rodrik, "Eastern Europe and the Soviet Union in the World Economy," March 1991 and CEPR, Monitoring European Integration, 1990.

enter into the estimation at all. However the one critical variable needed for the simulations is the total GDP and GDP per capita of the ECE countries. By far the largest caveat that needs to be made concerns the staggering variation in the estimates of the GDPs of the ECE countries. Table 8 presents an array of recent estimates of GDP for ECE countries and the USSR. The simulations reported so far use the World Bank estimates, which translate the official estimates into estimates of dollar GDP using a conversion factor rather than the official exchange rate. We think this is most appropriate for our purposes, as the relevant GDP for predicting the exports and imports of a country is its value in exchange in hard currency as opposed to PPP comparisons that are standard of living indices. As can be seen in the table, these World Bank estimates are towards the low end of the range (although given recent developments this may be a point in their favor). This obviously will bias downwards the expected trade with ECE partners.

The robustness of this assumption was checked by increasing the GDP and GDP per capita estimates of the ECE countries (including USSR) by up to 50%. As expected if one scales up the GDP and GDP per capita estimates by a large enough factor, about 50%, the predicted trade shares are nearly equal to the actual values (table 9). It seems reasonable to argue that for purposes of assessing current and medium-run future trade flows, the low range GDP estimates are more plausible. But an additional important implication emerges for the long-run. The fundamental interest of transition to market economies is to improve the poor economic performance of these countries. If this is successful, growth rates in the next 10-20 years ought to be well above world averages. Consequently, in the long-run, the geographic pattern of trade will be shifting back part of the way towards the current actual shares.

Table 9: Predicted levels of EE trade by region in 1980-82 at various levels of GDP per capita for the EE countries.

		GDP per capita increased by:		
	Actual	0%	25%	50%
EEurope	52.2%	15.4%	33.2%	59.1%
NEurope	27.4%	74.3%	59.3%	36.8%
SEurope	2.1%	3.1%	2.2%	1.2%
NAmerica	4.2%	3.7%	2.7%	1.5%
NAfrMst	8.4%	1.4%	1.0%	0.6%
EAsiaPac	1.8%	1.3%	0.9%	0.5%
SAsia	1.0%	0.2%	0.1%	0.1%
S&CAmer.	1.8%	0.5%	0.4%	0.2%
SSAfric	1.1%	0.2%	0.1%	0.1%
Total	100.0%	100.0%	100.0%	100.0%

On balance, despite the caveats, the basic conclusion -- that the expected pattern of trade of the ECE countries has been tremendously biased -- is quite robust. ECE is closely

surrounded by some of the world's largest markets and yet has very little interaction with them. Reasonable variants of the model and ranges of the values predict a massive shift of ECE trade towards the West, Northern Europe in particular.

Conclusions and Policy Implications

The enormity of distortion in trade orientation of ECE towards the CMEA made it easy for analysts to agree on the prediction of large shifts of trade towards the West. Gravity model simulations described here not only confirm these views but suggest an even more dramatic shift. Where actual trade flows for ECE countries were about 60-80% within CMEA, and 20-30% with Northern Europe, the simulations suggest a natural pattern that is almost exactly the reverse. While the numbers are subject to some margin of error, and in particular show less of a reorientation westward for higher assumed values of GDP in ECE, the general tendency is clear. The basic conclusion leads to two major implications: the need for large structural and policy change in ECE countries; and the need for accommodating to these new trade flows on the part of Western Europe.

As Havrylyshyn and Tarr (1991) emphasize, CMEA arrangements resulted both in an upward quantity bias towards internal trade patterns, and a downward quality bias. The huge shifts of volume and changes in quality implied in moving to new patterns would require either growth rates of trade and investments similar to the East Asian experience, or a period of adjustment extending into decades. It is of utmost importance for policy to encourage overall rapid growth to permit these shifts. This means first of

all, large infrastructural investments. Secondly, a set of transition policies providing a favorable investment climate. And third, a strongly outward-oriented open trade policy.

Of course, the gravity model results speak only to the long-run situation, and in themselves say nothing about the transition. However having an idea of the future should aid in forming present policies. Assured access to the rich European markets (EEC and EFTA) may be more important in the long run than the short-run maintenance of former CMEA markets. The abruptness of the dissolution of the CMEA exacerbated by the crash of Soviet markets is of course an immediate policy concern, but should not mask the fact that its impact is pushing the economy in the right direction. In the short run, it may be best treated as a macro problem of the demand-shock sort: former CMEA exports decline sharply before new demand opportunities can be exploited.

These new opportunities will be largely in the EEC markets, and the magnitude of the simulated shift gives credence to the point of Collins and Rodrik (1991) about the concerns of Western Europe over the increased imports from ECE. The base case estimate suggests an additional US$ 22 billion of imports into Northern Europe. Even without raising the issue of the status of ECE after 1992, it is clear that the pressure of import competition would increase dramatically. The total exports of Africa (including North Africa) with N. Europe in 1987 were only US$18 bn, that of all developing countries in Asia US$ 28 bn and of developing Europe US$ 41 bn. The reorientation of trade flows in the ECE countries could produce changes of the magnitude of

these levels. Given existing protectionist sentiments in the EEC, it is to be expected they will grow even stronger in anticipation of these shifts.

It needs to be emphasized that the shift is, like all trade, a two-way street, and an equal volume of EEC exports to ECE is also predicted. In a word the large increases in trade relations between East and Central Europe and the EEC, while entailing substantial adjustment problems, will also provide tremendous opportunities for trade, specialization and economic growth for both sides.

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Data appendix

Imports, Exports

Mij, Xij - Data on the average annual US dollar value of non-fuel (Total less SITC 3) imports and exports between each reporter and partner for 1980-82 were extracted from the UNSO COMTRADE database.

Geography

Distancei,j - the straightline distance between economic center of gravity of the respective countries, from Linneman (1966).

Borderi,j - =1 if countries i,j share a border, 0 otherwise.

Economic activity

GDPi - the GDP in US$ of the reporter (importer or exporter) from the World Bank Atlas. The atlas method uses a conversion factor other than the official when the official rate is wildly distorted.

GDPPCi - GDP per capita from World Bank Atlas.

Sizei - the land area of the reporter in '000 square kilometers.

Islandi - =1 if reporter is an island.

GDPj - the GDP in US$ of the partner country from World Bank Atlas.

GDPPCi - GDP per capita from World Bank Atlas.

Sizei - the land area of the partner in '000 square kilometers.

Islandi - =1 if partner is an island.

Linder - the absolute value of the difference in per capita GDP between the source and partner, from Summers and Heston (1988).

Trade preference arrangements

D ij - this is a dummy variable =1 if both countries are members of any type of preferential trading agreement. The arrangements included (depending on the sample) are: ASEAN, CACM, EEC, EFTA, LAFTA, and Lome convention preferences.

Cultural

L_{ij} - the only cultural factors considered are whether or not the countries share the same language, a very crude, but easily calculated proxy. Dummy variables were included for English, Spanish, Portuguese and Arabic.

Sample and regional groupings

The sample used in estimation was 95 non-socialist countries with imports greater than US$ 300 mn in 1980. In the simulations the following regional groupings were used:

Northern Europe - Austria, Belgium-Luxembourg, Denmark, Finland, France, W. Germany, Italy, Netherlands, Norway, Sweden, Switzerland and the UK.

Southern Europe - Greece, Ireland, Portugal, Spain, Turkey.

North America - Canada, USA.

North Africa and Middle East - Algeria, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Saudi Arabia, Syria, Tunisia, United Arab Emirates, Yemen.

East Asia and Pacific - Australia, Hong Kong, Indonesia, Japan, Korea, Malaysia, New Zealand, Philippines, Papua New Guinea, Singapore, Taiwan, Thailand.

South Asia - Bangladesh, Burma, India, Sri Lanka, Pakistan.

South and Central America - Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Haiti, Jamaica, Mexico, Nicaragua, Panama, Peru, Paraguay, El Salvador, Trinidad and Tobago, Uruguay, Venezuela.

Sub-Saharan Africa - Angola, Benin, Cote d'Ivoire, Cameroon, Congo, Ethiopia, Gabon, Ghana, Kenya, Liberia, Madagascar, Nigeria, Niger, Sudan, Senegal, Somalia, Togo, Tanzania, Zaire, Zambia, Zimbabwe

Eastern Europe as the reporter is the six European countries: Bulgaria, CSFR, Hungary, Poland, Romania, and Yugoslavia. As a partner in the tables the region includes East Germany and the USSR.

Appendix 1: Results for six ECE countries, 1980-82.

Imports

Poland

Region	Actual	Share	Predicted	Share	diff % total
EEurope	5643.273	52.298	1292.631	11.979	-40.319
NEurope	3242.795	30.052	8310.485	77.016	46.964
SEurope	137.973	1.279	200.045	1.854	0.575
NAmerica	808.818	7.496	642.104	5.951	-1.545
NAfrMEst	100.958	0.936	66.003	0.612	-0.324
EAsiaPac	256.627	2.378	169.936	1.575	-0.803
SAsia	89.317	0.828	14.726	0.136	-0.691
S&CAmer.	496.656	4.603	75.084	0.696	-3.907
SSAfric	14.118	0.131	19.522	0.181	0.050
Total	10790.53	100.000	10790.53	100.000	95.179

CSFR

Region	Actual	Share	Predicted	Share	diff % total
EEurope	7319.480	65.368	612.442	5.470	-59.899
NEurope	2682.905	23.960	10047.90	89.735	65.775
SEurope	139.902	1.249	96.743	0.864	-0.385
NAmerica	286.825	2.562	257.650	2.301	-0.261
NAfrMEst	157.046	1.403	53.284	0.476	-0.927
EAsiaPac	196.951	1.759	85.089	0.760	-0.999
SAsia	109.785	0.980	8.984	0.080	-0.900
S&CAmer.	279.660	2.498	27.301	0.244	-2.254
SSAfric	24.752	0.221	7.905	0.071	-0.150
Total	11197.30	100.000	11197.30	100.000	131.550

Hungary

Region	Actual	Share	Predicted	Share	diff % total
EEurope	3276.999	45.483	602.629	8.359	-37.124
NEurope	2835.626	39.333	6096.523	84.565	45.232
SEurope	125.291	1.738	99.888	1.386	-0.352
NAmerica	237.082	3.289	230.501	3.197	-0.091
NAfrMEst	69.230	0.960	53.926	0.748	-0.212
EAsiaPac	240.109	3.331	82.671	1.147	-2.184
SAsia	61.523	0.853	8.789	0.122	-0.731
S&CAmer.	293.253	4.068	26.644	0.370	-3.698
SSAfric	68.169	0.946	7.711	0.107	-0.839
Total	7209.282	100.000	7209.282	100.000	90.464

Bulgaria

Region	Actual	Share	Predicted	Share	diff % total
EEurope	3809.771	62.950	1731.061	28.603	-34.347
NEurope	1406.134	23.234	2551.922	42.166	18.932
SEurope	123.033	2.033	557.960	9.219	7.186
NAmerica	200.933	3.320	571.236	9.439	6.119
NAfrMEst	294.632	4.868	190.966	3.155	-1.713
EAsiaPac	127.200	2.102	311.119	5.141	3.039
SAsia	35.833	0.592	33.615	0.555	-0.037
S&CAmer.	51.232	0.847	78.703	1.300	0.454
SSAfric	3.266	0.054	25.451	0.421	0.367
Total	6052.034	100.000	6052.034	100.000	72.194

Romania

Region	Actual	Share	Predicted	Share	diff % total
EEurope	3116.033	32.503	1028.748	10.731	-21.772
NEurope	2063.333	21.522	7135.910	74.433	52.911
SEurope	214.334	2.236	267.741	2.793	0.557
NAmerica	714.333	7.451	650.342	6.784	-0.667
NAfrMEst	2618.333	27.311	132.965	1.387	-25.924
EAsiaPac	292.334	3.049	247.042	2.577	-0.472
SAsia	128.666	1.342	25.216	0.263	-1.079
S&CAmer.	184.666	1.926	77.177	0.805	-1.121
SSAfric	255.000	2.660	21.890	0.228	-2.432
Total	9587.032	100.000	9587.032	100.000	106.936

Yugoslavia

Region	Actual	Share	Predicted	Share	diff % total
EEurope	2721.513	24.364	1218.774	10.911	-13.453
NEurope	6109.982	54.698	8175.232	73.187	18.489
SEurope	250.692	2.244	411.667	3.685	1.441
NAmerica	926.485	8.294	661.795	5.925	-2.370
NAfrMEst	168.328	1.507	235.608	2.109	0.602
EAsiaPac	332.178	2.974	314.066	2.812	-0.162
SAsia	81.057	0.726	34.139	0.306	-0.420
S&CAmer.	339.347	3.038	90.249	0.808	-2.230
SSAfric	240.745	2.155	28.798	0.258	-1.897
Total	11170.32	100.000	11170.32	100.000	41.064

Exports

Poland

Region	Actual	Share	Predicted	Share	diff % total
EEurope	5919.093	57.851	2400.989	23.466	-34.384
NEurope	2689.003	26.281	7104.759	69.439	43.158
SEurope	199.011	1.945	216.130	2.112	0.167
NAmerica	368.664	3.603	296.795	2.901	-0.702
NAfrMEst	659.010	6.441	83.734	0.818	-5.623
EAsiaPac	117.162	1.145	39.371	0.385	-0.760
SAsia	87.292	0.853	7.788	0.076	-0.777
S&CAmer.	112.568	1.100	61.948	0.605	-0.495
SSAfric	79.857	0.780	20.146	0.197	-0.584
Total	10231.66	100.000	10231.66	100.000	86.650

CSFR

Region	Actual	Share	Predicted	Share	diff % total
EEurope	10119.69	73.226	1088.903	7.879	-65.347
NEurope	2173.208	15.725	12447.07	90.067	74.342
SEurope	165.416	1.197	87.032	0.630	-0.567
NAmerica	116.625	0.844	92.566	0.670	-0.174
NAfrMEst	824.112	5.963	60.637	0.439	-5.525
EAsiaPac	96.379	0.697	15.893	0.115	-0.582
SAsia	141.209	1.022	3.866	0.028	-0.994
S&CAmer.	122.692	0.888	17.269	0.125	-0.763
SSAfric	60.460	0.437	6.548	0.047	-0.390
Total	13819.79	100.000	13819.79	100.000	148.683

Hungary

Region	Actual	Share	Predicted	Share	diff % total
EEurope	4731.481	59.081	823.114	10.278	-48.803
NEurope	1981.954	24.748	6959.351	[illegible]	[illegible]
SEurope	141.460	1.766	73.095	[illegible]	-0.854
NAmerica	152.848	1.909	67.363	0.841	-1.067
NAfrMEst	737.278	9.206	50.887	0.635	-8.571
EAsiaPac	53.993	0.674	12.644	0.158	-0.516
SAsia	71.785	0.896	3.089	0.039	-0.858
S&CAmer.	50.604	0.632	13.776	0.172	-0.460
SSAfric	87.104	1.088	5.186	0.065	-1.023
Total	8008.507	100.000	8008.507	100.000	124.303

Bulgaria

Region	Actual	Share	Predicted	Share	diff % total
EEurope	3999.694	73.501	2739.655	50.346	-23.155
NEurope	575.832	10.582	1390.044	25.544	14.963
SEurope	166.735	3.064	808.985	14.867	11.802
NAmerica	32.333	0.594	176.615	3.246	2.651
NAfrMEst	496.700	9.128	197.680	3.633	-5.495
EAsiaPac	37.833	0.695	52.999	0.974	0.279
SAsia	80.166	1.473	13.157	0.242	-1.231
S&CAmer.	21.533	0.396	43.612	0.801	0.406
SSAfric	30.834	0.567	18.913	0.348	-0.219
Total	5441.660	100.000	5441.660	100.000	60.202

Romania

Region	Actual	Share	Predicted	Share	diff % total
EEurope	3661.667	36.443	2361.664	23.505	-12.938
NEurope	2802.667	27.894	6652.845	66.213	38.319
SEurope	572.000	5.693	329.078	3.275	-2.418
NAmerica	480.000	4.777	323.897	3.224	-1.554
NAfrMEst	2024.333	20.147	206.067	2.051	-18.097
EAsiaPac	160.000	1.592	64.926	0.646	-0.946
SAsia	171.933	1.711	15.241	0.152	-1.559
S&CAmer.	77.001	0.766	68.571	0.682	-0.084
SSAfric	98.000	0.975	25.311	0.252	-0.723
Total	10047.60	100.000	10047.60	100.000	76.639

Yugoslavia

Region	Actual	Share	Predicted	Share	diff % total
EEurope	4860.341	49.576	1591.912	16.238	-33.339
NEurope	2500.385	25.504	7331.526	74.783	49.279
SEurope	157.004	1.601	380.641	3.883	2.281
NAmerica	391.561	3.994	171.891	1.753	-2.241
NAfrMEst	1415.810	14.442	211.586	2.158	-12.283
EAsiaPac	82.666	0.843	44.272	0.452	-0.392
SAsia	84.530	0.862	11.145	0.114	-0.749
S&CAmer.	43.719	0.446	42.638	0.435	-0.011
SSAfric	267.718	2.731	18.124	0.185	-2.546
Total	9803.734	100.000	9803.734	100.000	103.119

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